

Bluetooth® v4.0 smart ready module

Datasheet - preliminary data

**Features**

- Bluetooth radio
 - Fully embedded Bluetooth v4.0 with profiles
 - Class 1 radio
 - 128-bit encryption security
 - Integrated antenna
 - Dual mode Bluetooth classic and low energy supported
- ST Micro Cortex-M4 microprocessor up to 84 MHz (256 kb Flash, 48 kb RAM)
- Serial interface
 - UART
- General I/O
 - 8 general purpose I/O
 - 1 LPO input
- User interface
 - AT command set (abSerial)
 - Firmware upgrade over UART
- CE, FCC and BQE qualification (pending)
- Single voltage supply: 2.5 V (typ)
- Micro-sized form factor: 11.6 x 13.5 x 2.9 mm
- RoHS compliance

Application

- Serial cable replacement
- M2M industrial control
- Service diagnostic
- Data acquisition equipment
- Machine control
- Sensor monitoring
- Security system

Description

The SPBT2932DM micro-sized Bluetooth smart ready module with integrated antenna boasts the smallest form factor available for a complete RF platform.

The SPBT2932DM is a surface mount PCB module that provides fully embedded, ready-to-use Bluetooth wireless technology.

The SPBT2932DM supports both Bluetooth classic and low energy (LE), version v4.0.

Our standard AT command set and Bluetooth stack are pre-Flashed into the integrated Flash memory, supporting Bluetooth 3.0 profiles and Bluetooth 4.0 services. Commands will be listed in the FW user manual UM1801.

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1 Software architecture

1.1 Lower layer stack

- Bluetooth v4.0 classic and low energy
- Device power modes: active, sleep and deep sleep
- Wake on Bluetooth feature for optimized power consumption of host CPU
- Authentication and encryption
- Encryption key length from 8-bits to 128-bits
- Persistent Flash memory for BD address and user parameter storage
- All ACL (asynchronous connection-less) packet types

1.2 Upper layer stack: Data FW

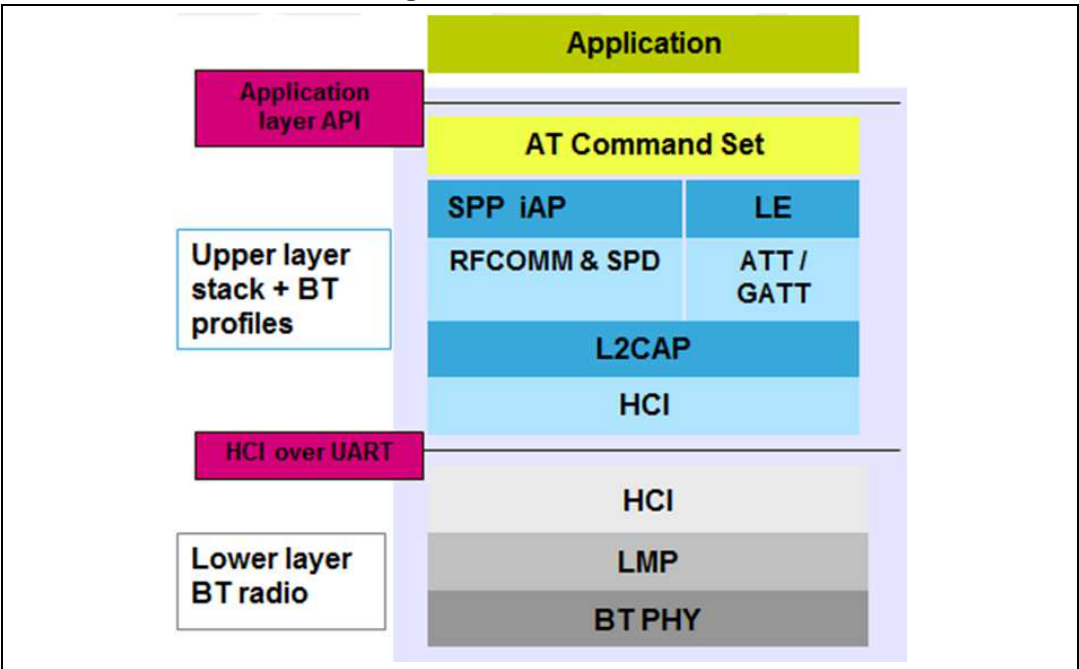
- SPP and iAP Classic profiles, battery and private low energy services
- Protocols: classic (RFCOMM, SDP, L2CAP). Low energy (ATT/GATT)

1.3 AT Command Set

The complete command list including the Bluetooth classic and low energy commands is included in user manual UM1801.

1.4 Bluetooth firmware implementation

Figure 1. FW architecture



2 Hardware specifications

General conditions (V_{IN} = 2.5 V and 25 °C)

2.1 Recommended operating conditions

Table 1. Recommended operating conditions

Rating	Min.	Typ.	Max.	Unit
Operating temperature range ⁽¹⁾	-20		60	°C
Supply voltage V_{IN}	2.0	2.5	3.6	V
Signal pin voltage		2.1		V
RF frequency	2402		2483.5	MHz

1. T value will be published at the end of module qualification test.

2.2 Absolute maximum ratings

Table 2. Absolute maximum ratings

Rating	Min.	Typ.	Max.	Unit
Storage temperature range	-55		105	°C
Supply voltage V_{IN}	-0.3	2.5	5.0	V
I/O pin voltage (V_{IO} five-volt tolerant pin)	-0.3	2.1	5.5	V
RF input power			-5	dBm

2.3 CPU current consumption

- Standard CPU mode 8 MHz
- UART supports up to 115 Kbps
- Data throughput up to 200 Kb
- FW version 1.5
- Shallow sleep enabled

Table 3. Current consumption

Modes (typical power consumption)	Avg	Unit
ACL data 115 K baud UART at max. throughput (master)	16.5	mA
ACL data 115 K baud UART at max. throughput (slave)	18.5	mA
Connection, no data traffic, master	5.2	mA
Connection, no data traffic, slave	7.4	mA

Table 3. Current consumption (continued)

Modes (typical power consumption)	Avg	Unit
Connection 375 ms sniff (external LPO required)	590	μA
Standby, without deep sleep	4.9	mA
Standby, with deep sleep, no external LPO	1.2	mA
Standby, with deep sleep, with external LPO	140	μA
Page/inquiry scan, with deep sleep, no external LPO	2.6	mA
Page/inquiry scan, with deep sleep, with external LPO	720	μA
BLE advertising, 1.28sec non-connectable, with external LPO	195	μA
BLE advertising, 1.28sec discoverable, with external LPO	215	μA
Bluetooth power down / CPU standby	11	μA

2.4 I/O operating characteristics

Table 4. I/O operating characteristics

Symbol	Parameter	Min.	Max.	Unit	Conditions
V _{IL}	Low-level input voltage	-	0.6	V	V _{IN} , 2.1 V
V _{IH}	High-level input voltage	1.4	-	V	V _{IN} , 2.1 V
V _{OL}	Low-level output voltage	-	0.4	V	V _{IN} , 2.1 V
V _{OH}	High-level output voltage	1.8	-	V	V _{IN} , 2.1 V
I _{OL}	Low-level output current	-	4.0	mA	V _{OL} = 0.4 V
I _{OH}	High-level output current	-	4.0	mA	V _{OH} = 1.8 V
RPU	Pull-up resistor	80	120	kΩ	Resistor turned on
RPD	Pull-down resistor	80	120	kΩ	Resistor turned on

2.5 Selected RF characteristics

Table 5. Selected RF characteristics

Parameters	Conditions	Typical ⁽¹⁾	Unit
Antenna load		50 ohm	
Radio receiver			
Sensitivity level	BER <.001 with DH5	-92	dBm
Maximum usable level	BER <.001 with DH1	0	dBm

Table 5. Selected RF characteristics (continued)

Parameters	Conditions	Typical ⁽¹⁾	Unit
Input VSWR		2.5:1	
Radio transmitter			
Maximum output power	50 Ω load	+ 12	dBm
Initial carrier frequency tolerance		0	kHz
20 dBm bandwidth for modulated carrier		935	kHz

1. RF characteristics can be influenced by physical characteristics of final application.

2.6 Pin assignment

Figure 2. Pin connection diagram

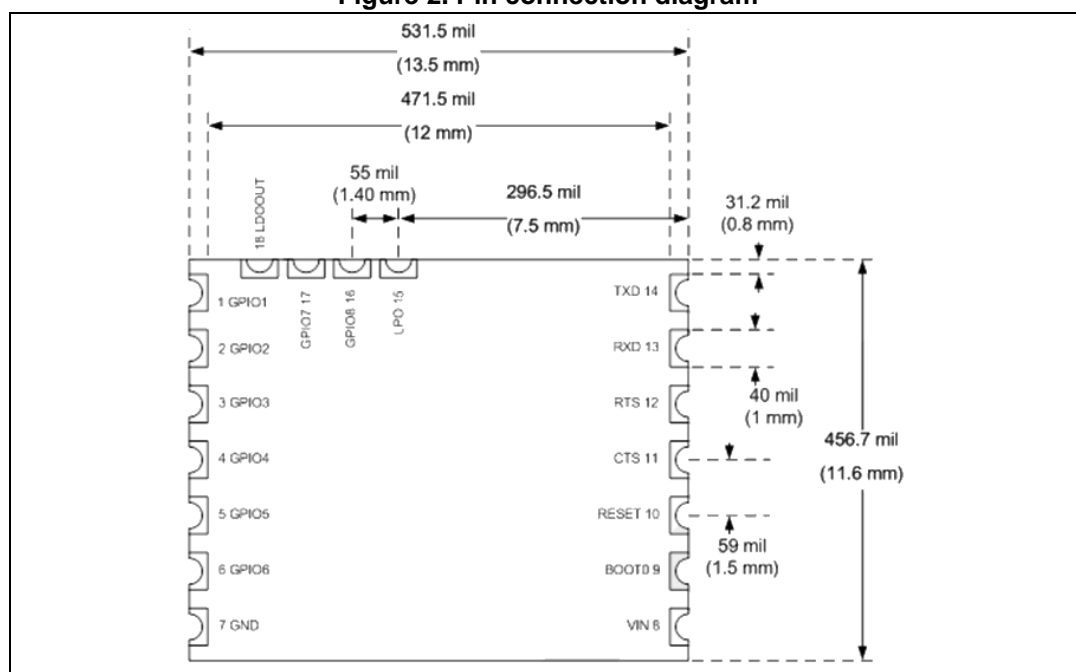


Table 6. Pin assignment

Name	Type	Pin #	Description	ALT function	5 V tolerant	Initial state
UART interface						
RXD	I	13	Receive data		Y	
TXD	O	14	Transmit data		Y	
RTS	O	12	Clear to send (active low)	I2C data	Y	
CTS	I	11	Request to send (active low)	I2C clock	Y	
Boot loader						
Boot 0	I	9	Boot 0			
Power and ground						
V _{in}		8	V _{in}			
GND		7	GND			
LDout		18	LDO output 2.1 V			
Reset						
RESETN	I	10	Reset input (active low for 5 ms)		(1.8 V + 0.3 V) max.	
LPO						
LPCLK	I	15	LPO input			
GPIO – general purpose input/output						
GPIO [1]	I/O	1	General purpose input/output		Y	Input pull down
GPIO [2]	I/O	2	General purpose input/output	I2S_SD	Y	Floating
GPIO [3]	I/O	3	General purpose input/output	I2S_CLK	Y	Input pull down
GPIO [4]	I/O	4	General purpose input/output	I2S_WS	Y	Input pull down
GPIO [5]	I/O	5	General purpose input/output	I2C data	Y	Input pull down

Table 6. Pin assignment (continued)

Name	Type	Pin #	Description	ALT function	5 V tolerant	Initial state
GPIO [6]	I/O	6	General purpose input/output	I2C clock	Y	Input pull down
GPIO [7]	I/O	17	General purpose input/output	ADC 0	Y	Input pull down
GPIO [8]	I/O	16	General purpose input/output	ADC 1	Y	Input pull down

3 Mechanical dimensions

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Figure 3. Mechanical dimensions

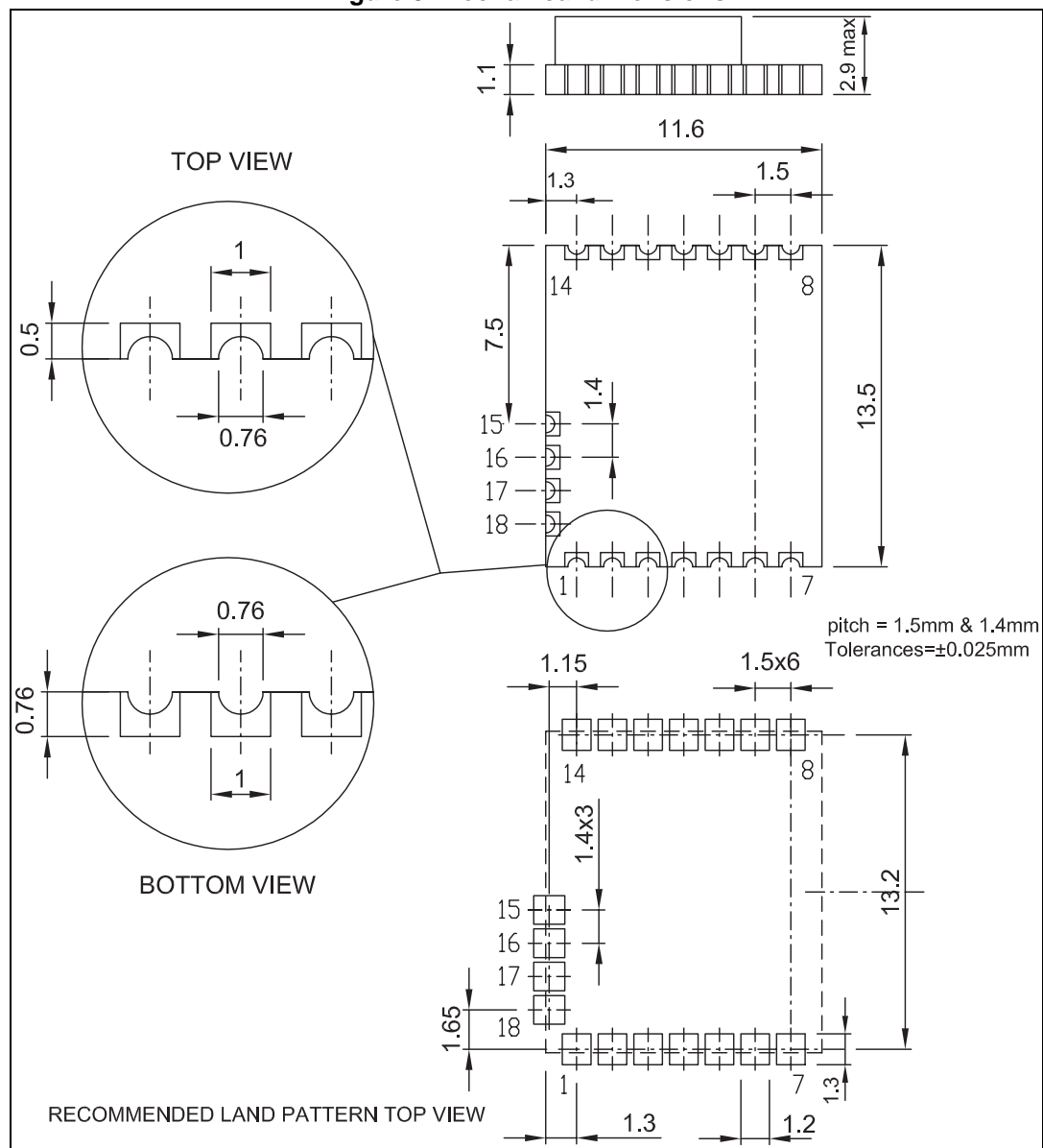
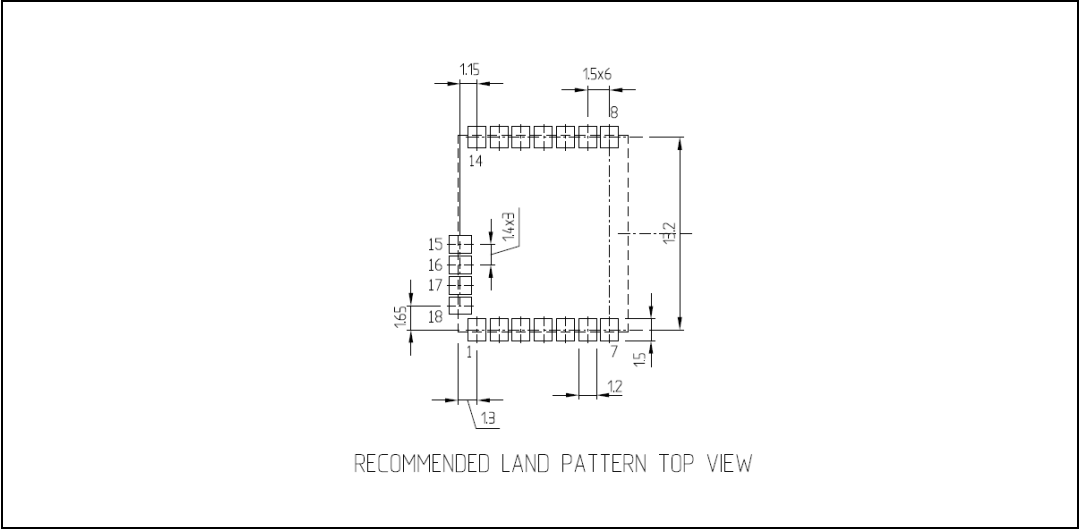
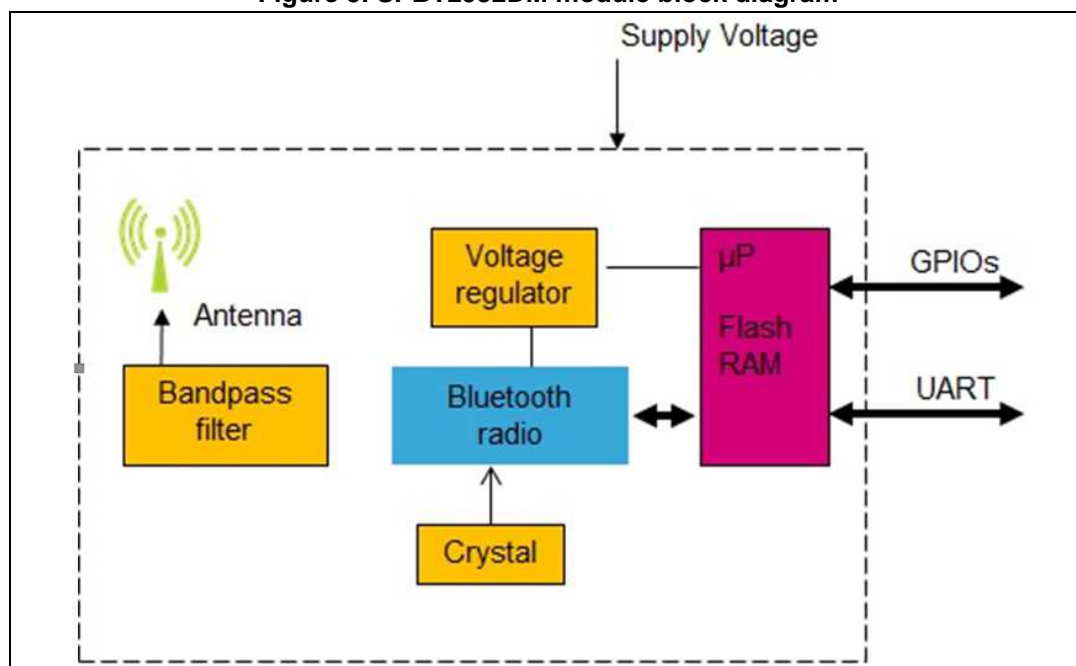


Figure 4. Recommended land pattern



4 Hardware block diagram

Figure 5. SPBT2932DM module block diagram



5 Hardware design

The SPBT2932DM module supports UART and GPIO hardware interfaces.

Please note that:

- All unused pins should be left floating; do not ground.
- All GND pins must be well grounded.
- The area around the module should be free of any ground planes, power planes, trace routings, or metal for 6 mm from the antenna in all directions.
- Traces should not be routed underneath the module.

5.1 Module reflow installation

The SPB2932DM is a surface mount Bluetooth module supplied on an 18-pin, 6-layer PCB. The final assembly recommended reflow profiles are indicated below.

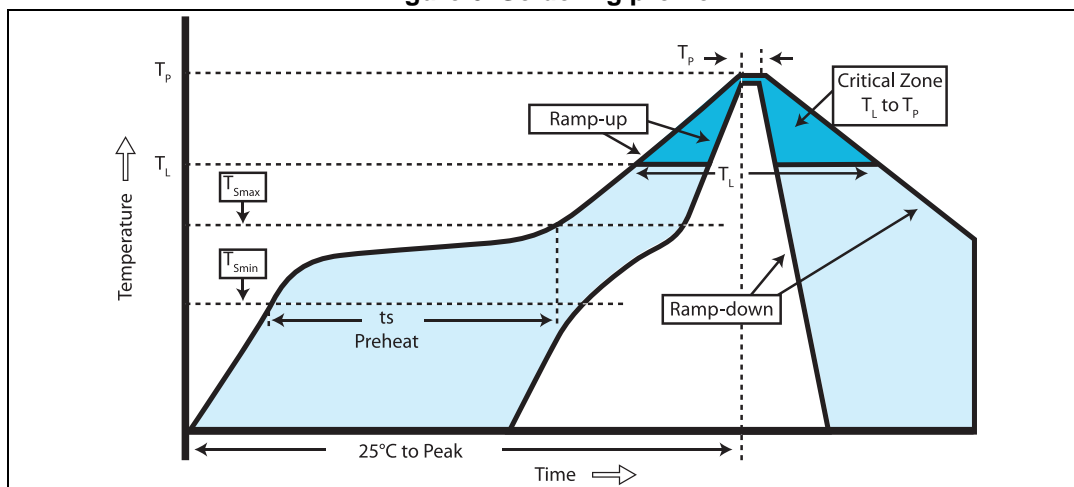
The soldering phase must be executed with care. In order to avoid the undesired melting, particular attention must be taken during the setup of the peak temperature.

The following provides some suggestions for the temperature profile based on IPC/JEDEC J-STD-020C, July 2004 recommendations.

Table 7. Soldering

Profile feature	PB-free assembly
Average ramp-up rate ($T_{S\text{MAX}}$ to T_p)	3 °C/sec max
Preheat	
Temperature min (T_S min)	150 °C
Temperature max (T_S max)	200 °C
Time (t_S min to t_S max) (t_S)	60-100 sec
Time maintained above:	
Temperature T_L	217 °C
Time t_L	60-70 sec
Peak temperature (T_p)	240 ± 0 °C
Time within 5 °C of actual peak temperature (t_p)	10-20 sec
Ramp-down rate	6 °C/sec
Time from 25 °C to peak temperature	8 minutes max

Figure 6. Soldering profile



5.2 GPIO interface

All GPIOs are capable of sinking and sourcing 6 mA of I/O current. GPIO [1] to GPIO [8] are internally pulled down with 100 k Ω (nominal) resistors, except GPIO [2], which is floating.

5.3 GPIO configuration

Module GPIO configuration depends on the FW embedded.

GPIO can be reconfigured using the following commands:

- At+ab gpioconfig [GPIO pin] [I/O]
- At+ab gpioRead [GPIO pin]
- At+ab gpioWrite [GPIO pin] [1/0]

For additional details, refer to user manual UM1801.

5.4 UART interface

The UART is compatible with the 16550 industry standard. Four signals are provided with the UART interface. The TXD and RXD pins are used for data while the CTS and RTS pins are used for flow control.

Figure 7. Connection to host device

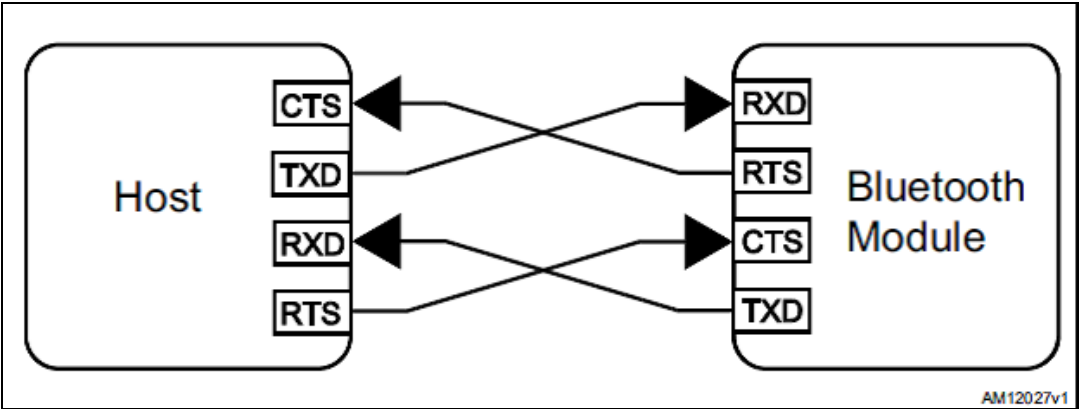
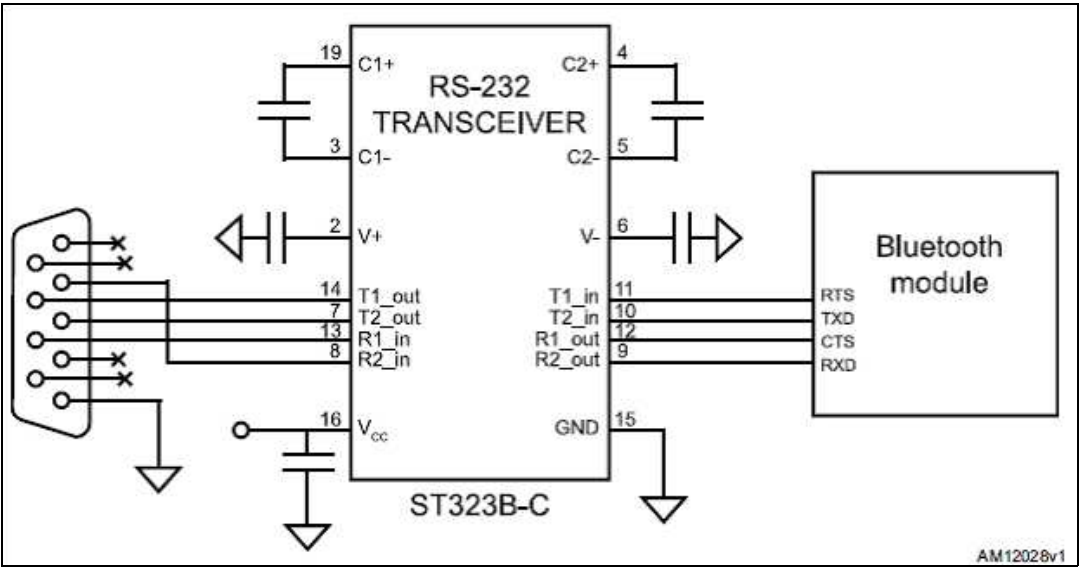
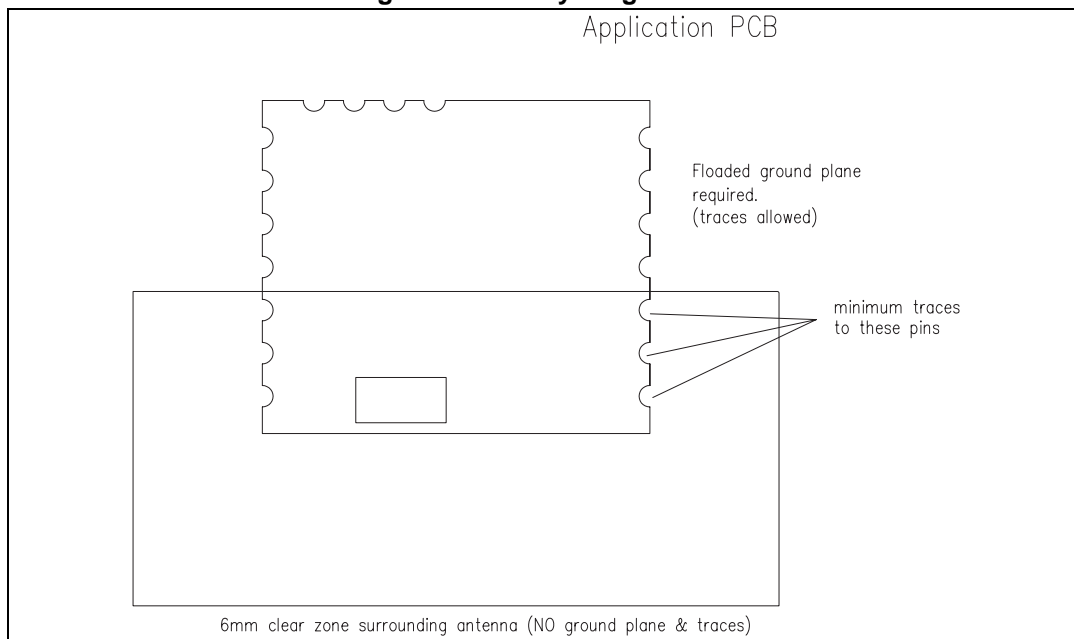


Figure 8. Typical RS232 circuit



5.5 PCB layout guideline

Figure 9. PCB layout guideline

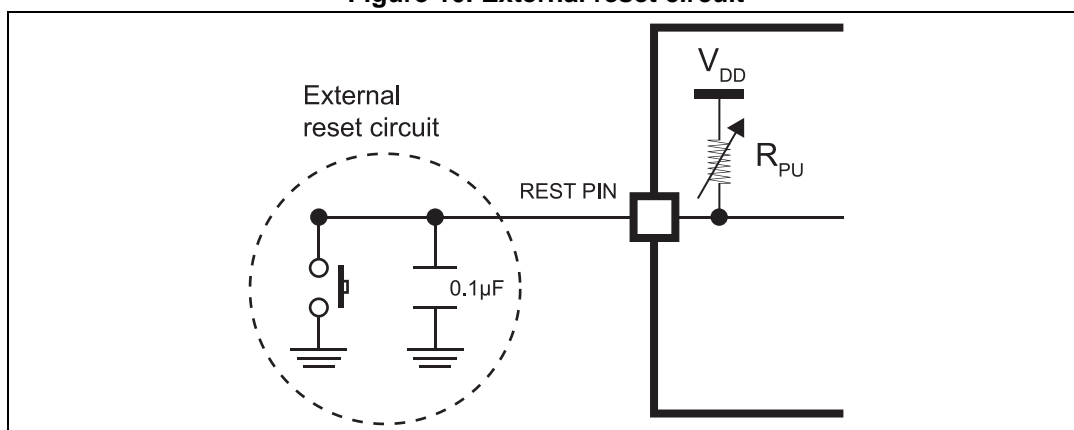


5.6 Reset circuit

Two types of system reset circuits are detailed below. The maximum voltage that can be supplied to the RESET pin is 2.5 V. As shown in [Figure 10](#) and [Figure 11](#), the RESET is active low. In the absence of a reset circuit, the pin is internally pulled up and therefore inactive.

5.6.1 External reset circuit

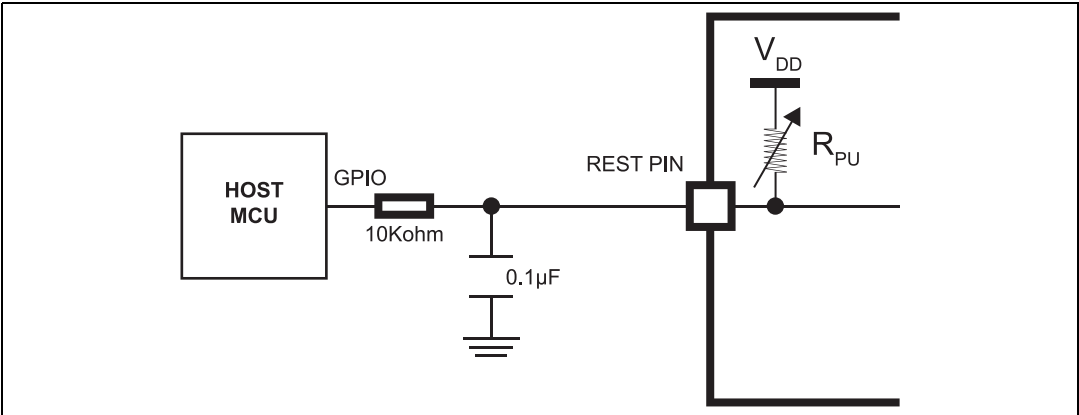
Figure 10. External reset circuit



Note: R_{PU} ranges from 30 kΩ to 50 kΩ internally.

5.6.2 Internal reset circuit

Figure 11. Internal reset circuit



Note: R_{PU} ranges from 30 kΩ to 50 kΩ internally.
 R_{RST} should be from 1 kΩ to 10 kΩ.

5.7 External LPO input circuit

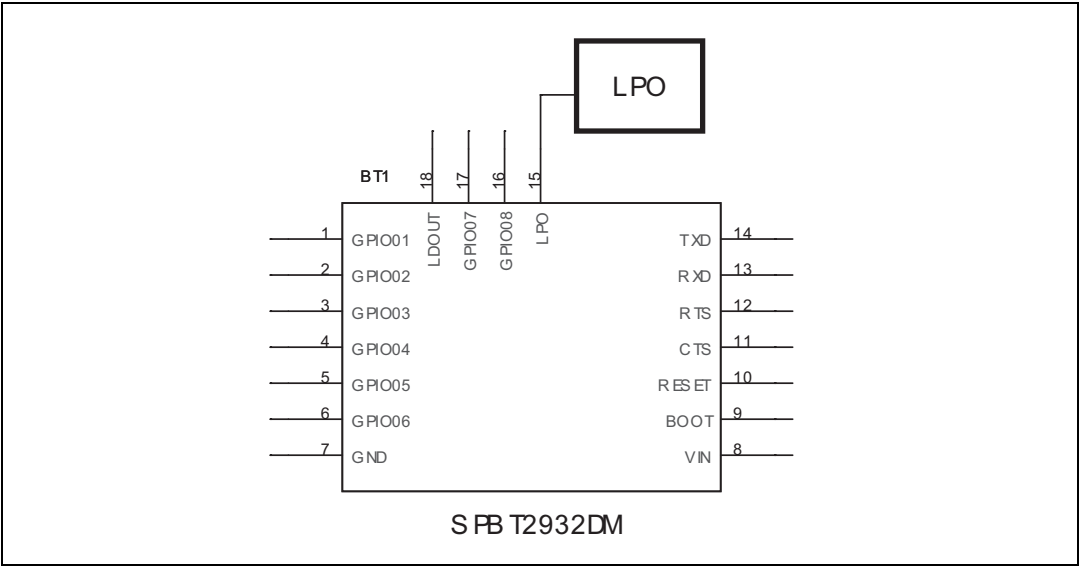
An optional low power oscillator input may be added to allow deep sleep and sniff modes.

- LPO parameters:
 - Frequency: 32.768 kHz
 - Tolerance: +/- 150 ppm typical, +/- 250 maximum
 - Absolute maximum supplied voltage at LPO pin: +1.8 V
 - VIL min/max = 0 V/+0.5 V
 - VIH min/max = +1.47 V/+1.8 V
 - Input capacitance: 2.5 pF maximum
- Configurations:
 - Use two configuration variables: UseExtLPO and AllowSniff.

Table 8. System configuration variables

Variable	Name	Default	Description
Var..	UseExtLPO	auto	True when a 32.768 kHz low power oscillator is present, and false if not present.
Var..	AllowSniff	false	Enables sniff mode. Must be false when no 32.768 kHz LPO is present.

Figure 12. External LPO circuit



6 Regulatory compliance

6.1 FCC and IC certification

This module has been tested and found to comply with the FCC part 15 and IC RSS-210 rules. These limits are designed to provide reasonable protection against harmful interference in approved installations. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference may not occur in a particular installation.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference
2. this device must accept any interference received, including interference that may cause undesired operation.

Modifications or changes to this equipment not expressly approved by the part responsible for compliance may render void the user's authority to operate this equipment.

- Modular approval, FCC and IC

FCC ID: X3ZBTMOD7

IC: 8828A-MOD7

In accordance with FCC part 15, the SPBT2932DM is listed above as a modular transmitter device.

- Label instructions

When integrating the SPBT2932DM into the final product, it must be ensured that the FCC labeling requirements, as specified below, are satisfied. Based on the public notice from FCC, the product into which the ST transmitter module is installed must display a label referring to the enclosed module. The label should use wording such as the following:

Contains transmitter module

FCC ID: X3ZBTMOD7

IC: 8828A-MOD7

Any similar wording that expresses the same meaning may be used.

6.2 Bluetooth certification

The module with embedded stack and profile has been qualified according to SIG qualification rules:

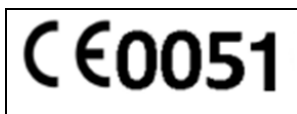
- Bluetooth SIG Qualified Design, QD ID: 58674
- Product type: End Product
- TGP version: Core 4.0
- Core spec version: 4.0
- Product descriptions: Bluetooth module, spec v4.0

6.3 CE certification

Module has been certified according to following certification rules:

- CE Expert Opinion: TBD
- Measurements have been performed in accordance with (report available on request):
 - EN 300 328 V 1.8.1 (2012 06) ^(a)
 - EN 301 489-17 V 2.2.1 (2012 09) ^(b)
 - EN 301 489 -1 V 1.9.2 (2011 09) ^(c)
 - EN60950-1:2006 +A11:2009+A1:2010 ^(d)

CE certified:



-
- a. EN 300 328 V 1.8.1 (2012 06): "Electromagnetic compatibility and radio spectrum matters (ERM); Wideband transmission systems; data transmission equipment operating in the 2.4 GHz ISM band and using wideband modulation techniques; harmonized EN covering essential requirements under article 3.2 of the R&TTE directive".
- b. EN 301 489-17 V 2.2.1 (2012 09): "Electromagnetic compatibility and radio spectrum matters (ERM); Electromagnetic compatibility (EMC) standard for radio equipment and services; part 17: specific condition for 2.4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment".
- c. EN301 489-1 V 1.9.2 (2011 09): "Electromagnetic compatibility and radio spectrum Matters (ERM); Electromagnetic compatibility (EMC) standard for radio equipment and services; part 1: Common technical requirements".
- d. EN60950-1:2006 +A11:2009+A1:2010: "Information technology equipment - safety".

7 Traceability

Each module is uniquely identified by a serial number stored in a 2D data matrix laser-marked on the bottom side of the module.

The serial number has the following format:

WW YY D FF NNN

Where:

- WW = week
- YY = year
- D = product ID family
- FF = production panel coordinate identification
- NNN = progressive serial number

Each module bulk is identified by a bulk ID.

Bulk ID and module 2D data matrix are linked by a reciprocal traceability link.

The module 2D data matrix traces the lot number of any raw material used.

8 Ordering information

Table 9. Ordering information

Order code	Description	Packing	MOQ
SPBT2932DM	Bluetooth V4.0 data module	JEDEC tray	2448 pcs

9 Revision history

Table 10. Document revision history

Date	Revision	Changes
05-Sep-2014	1	Initial release.
23-Sep-2014	2	Table 1 has been modified. Document status promoted from product preview to preliminary data.

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